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THE COST OF THE ERIE BARGE CANAL

I

The latest report of the State Engineer and Surveyor of New York¹ contains an account of the progress that has been made on the New York barge-canal system to date, and some revised estimates of the probable eventual cost of the undertaking. It is the purpose of this paper to outline and discuss the situation as it has developed in New York, in the hope that the experience there may prove of some service to other localities that are planning extensive waterway improvements.

Canals have notoriously cost far more in the building than the original hopeful estimates. To take but a few illustrations: The first estimate for the Suez Canal was \$30,000,000; but it required \$80,000,000 to complete the project. The original estimate for the Chicago Drainage Canal was \$16,000,000; the ultimate cost was \$53,000,000. The first very carefully prepared estimates for the Manchester Ship Canal in England called for an outlay of £8,262,936; the actual cost became £16,790,491.² It was originally believed that the Panama Canal could be constructed for \$140,000,000; the final cost has proved to be approximately \$375,000,000.³ Such has been the almost universal experience, except in Germany, where faulty preliminary estimates have been comparatively rare. The experience in New York has followed the general rule.

By act of the legislature and a referendum vote in 1903 the state of New York appropriated \$101,000,000 for the rehabilitation of the state canal system. The law provided that the new Erie Canal should be 12 instead of 7 feet deep and that the locks should be 28 feet wide and 328 feet long.

According to this [State Engineer's] estimate the canal construction work involved would cost approximately \$84,000,000. The balance of the appropriation was designed to cover damages, engineering, incidental expenses, and

¹ *Barge Canal Bulletin*, January, 1915 (published monthly at Albany, New York).

² In this case the project would never have been undertaken had there been any thought that the ultimate cost would much exceed the estimate.

³ This includes \$50,000,000 paid to France for her rights in the premises.

contingencies. It was also estimated that \$2,000,000, would be realized by the sale of abandoned canal lands, . . . where the line of the present canal was deviated from in the course of the new construction. This amount it was estimated would be turned back into the canal fund for the general uses of the appropriation, thus making the estimated total cost of the canal \$103,000,000, of which \$2,000,000 would be recovered.¹

Let us see how these expectations have been fulfilled.

A series of wholly unexpected events have occurred which have rendered the foregoing estimates quite inadequate. The first of these came in 1906 when the legislature amended the original law so as to increase the width of the locks from 28 feet to 45 feet. This has added \$2,500,000 to the cost of construction without increasing the appropriation. Several smaller amendments passed by the legislature have added \$250,000 to this amount.

A second unanticipated expense has been due to delays in settlement with railroads whose lines have been crossed by new canal lines. This has required changes in railroad grades and alignments and the construction of new bridges. The advent of the Democratic state administration in 1911 resulted in throwing the question of the legality of the already consummated agreements with the railroads into the courts. "After three years of litigation the Court of Appeals has upheld the settlements made prior to 1911. This litigation, however, made it necessary to cancel several of the existing contracts for the reason that it was not possible to provide the contractors with the entire site of their contracts."² Other contracts, also, became involved; and, to make a long story short, the State Engineer now believes that the litigation damage claims and added expenses due to "resurveying, readvertising, and the movement of heavy machinery" have increased the total outlays on this account by \$5,000,000.

A third cause of additional expense has been two unexpected breaks in the line of the canal east of Rochester, one in 1911 and one in 1912. On these \$400,000 has already been expended, and the Engineer estimates that permanent repairs will entail an additional outlay of \$250,000.

¹ *Barge Canal Bulletin*, January, 1915, p. 3.

² *Ibid.*, p. 4.

Fourthly, the rebuilding of public highways destroyed by construction operations on the canal has cost the state to date over \$1,250,000.

Fifthly, services rendered by the state departments of Comptroller and Claims and by the Appraiser have added \$710,000 to the total. The original estimate made no allowance for these items.¹

Sixthly, "no provision was made in the 1903 estimate which at all adequately provided for the enormous damage claims" filed by private property-holders. It was not contemplated that the various water-power developments along the route would be entitled to damages for alterations in dams to meet the requirements of the new canal. The land damages were vastly underestimated; and much additional expense has been encountered through the "unexpected" delay in the adjudication of these claims in court. There have been filed up to the present time land damage claims to the amount of \$19,000,000; water-power damage claims to the amount of \$38,000,000; railroad-crossing claims to the amount of \$8,700,000; and damage claims by contractors to the amount of \$7,000,000; making a total in round numbers of \$72,700,000.² The State Engineer adds, however, that "many of these claims are very excessive and it is reasonable to assume that no just awards will reach much over one-third of the total sum claimed."³ This is a grudging admission of at least \$25,000,000 for claims thus far presented. The court awards, delayed as they have been, have already amounted to over \$10,000,000.⁴

Finally, the incidental expenses were grossly underestimated. "The necessity of maintaining navigation on the old canal while building the enlarged channel on the same site, as is the case in many sections, presented a number of unexpected and expensive difficulties."⁵ "Injunctions on the part of property-owners which delayed work or made necessary the readjustment of plans have also added to the expense."⁶ The total charge for engineering, including the charges for consulting engineers, has amounted to \$9,100,000—much in excess of the anticipations. The straight *con-*

¹ *Barge Canal Bulletin*, January, 1915, p. 5.

² *Ibid.*

³ *Ibid.*

⁴ *Ibid.*

⁵ *Ibid.*, p. 4.

⁶ *Ibid.*, p. 5.

struction costs have also been substantially increased, owing to "the increased cost of materials, particularly with reference to concrete, the Eight-Hour Labor law, and the Workmen's Compensation law, both pieces of legislation passed subsequently to the making of the estimate in 1903."¹

The net result is that with only 85 per cent of the construction work on the canal completed, the appropriation of \$101,000,000 is overdrawn. "The state is at this moment obligated to an expenditure of \$1,500,000 more than is available in the appropriation."² Unless an additional appropriation is made no section of the canal will be available for through traffic by large barges as the work remaining to be done is so located that the completed sections could be utilized for local traffic only. Construction work must cease altogether by June 1 unless a further appropriation is made.

The State Engineer now estimates that to complete the project an additional sum of \$27,000,000 will be required. Perhaps this estimate is proportionally as wide of the ultimate mark as the previous ones. In particular the damage claims may much exceed the estimate of the Engineer. As seen from the figures above, he admits a probable \$25,000,000, only \$10,000,000 of which has as yet been paid. His estimate of a one-third settlement basis would seem to be very conservative. A doubt of this estimate is admitted by the Engineer himself, where he says: "The amount required to cover such damages is difficult for me to determine accurately, particularly as the adjudication of such damage claims is in the hands of departments other than that of the State Engineer."³ All things considered, if the history of this and other projects may serve as a guide we need not be at all surprised if the total cost eventually reaches \$135,000,000.

Parenthetically, it is worth noting that the engineers originally hoped that the project would be completed and ready for use with the opening of navigation in the spring of 1915. It is now the hope of the department that, if the additional appropriation required is granted at once, two sections of the canal, from Troy to Whitehall and from Waterford to Otsego—roughly half the total distance—will be ready for local traffic by the opening of navigation in 1916.⁴

¹ *Ibid.*, p. 4.

² *Ibid.*, p. 6.

³ *Ibid.*

⁴ *Ibid.*

It would appear, therefore, that it will be at least three years yet before the undertaking as a whole is completed.

To return to the question of cost, it will be of interest to reduce the foregoing figures to a mileage basis. The project in New York is a system of canals rather than a single line, and is composed of the Erie, Champlain, Oswego, and Cayuga and Seneca branches. The appropriation of \$101,000,000 was for the first three branches; while a separate appropriation of \$7,000,000 was made in 1909¹ for the Cayuga and Seneca branch, which is 27.5 miles in length. The lengths of the Erie, Champlain, and Oswego branches are 323, 61.5, and 22.8 miles, respectively, giving a total of 407.3 miles for the main system. The average cost per mile has therefore been approximately \$330,000 ($\$135,000,000 \div 407.3$). Since the canal connects with the Hudson River, however, it makes possible a continuous water route from Buffalo to New York City. Spreading the same cost over this longer distance reduces the average to approximately \$260,000 per mile.² This is exclusive of the cost of necessary improvements on the Hudson, particularly the construction of a large dam and locks near Troy.

II

All of the foregoing costs, it should be observed, are merely for the acquisition of canal sites, and for the construction of the channel, locks, etc. They make no allowance for the indispensable terminal facilities, such as docks, wharves, freight depots, and transshipping machinery. This failure to provide (originally) for these terminal facilities affords an excellent illustration of the utterly haphazard fashion in which public works are undertaken in this country. Campaign orators, chambers of commerce, specially interested shipping associations, waterway conventions, and state and national commissions had for many years portrayed the wonderful possibilities of water transportation and fanned the enthusiasm of the public to a white heat, before there was even so much

¹ *Barge Canal Bulletin*, December, 1913, p. 410.

² Of course it also connects with a good many miles of lake navigation in the interior of the state; but this is not of importance from the standpoint of through traffic.

as a reference to the terminal question. Indeed, it was not until 1909 that it made its belated appearance,¹ in a government report, six years after the decision to rehabilitate the old Erie Canal.

But when it finally dawned upon us that a canal without terminals would be a sorry competitor indeed for modern railroads, we buckled to with characteristic American courage and promptly shouldered the full responsibility of providing the necessary terminal facilities, just as though we had long been preparing for this very task. The United States Bureau of Corporations was delegated to make an exhaustive report on the subject and in 1909 the state of New York appointed a Barge Canal Terminal Commission for the purpose of investigating the terminal situation in New York with a view to making an appropriation. After an extensive investigation costing \$10,000, the commission came to the important, though obvious, conclusion that "it is just as necessary that there shall be frequent, convenient, well-established, thoroughly equipped, and wisely managed depots all along the canals and waterways, where canal-borne freight may be received, cared for, and shipped away, as it is necessary that the railroads shall have their freight depots."² It was found that a good waterway terminal has four prime factors: adequate wharves; warehouse space; transshipping machinery; and belt-line railway connections between the water routes and adjacent railways and local industries. Henceforth, the development of these necessary terminal facilities had to be included in estimating the total cost of the undertaking.

In 1911 the legislature, acting upon the commission's report, appropriated \$19,800,000 for the purpose of constructing terminals for the barge-canal system. This was approved by a referendum vote of the people in November of that year.³ Provision was made in this appropriation for New York and Buffalo at the termini of the route, and for about fifty intermediate towns. Whether the sum appropriated is the usual underestimate remains to be seen, of course, but there is little reason for believing that the amount is at

¹ This is admitted by the Terminal Engineer of New York (*Barge Canal Bulletin*, June, 1914, p. 198).

² *Report of the Barge Canal Terminal Commission*, 1911, I, 39.

³ *Barge Canal Bulletin*, April, 1913, p. 146.

all adequate. Study of the report inclines one to believe that while the provision of the necessary docks and wharves has received pretty careful consideration, the matter of transshipping machinery, storage depots, and belt-railway connections has been slighted not a little. Even in the case of the docks and wharves these preliminary cost estimates may well prove far from adequate. There will doubtless be the usual "unanticipated" claims-department charges, appraiser's expenses, comptroller's fees, "incidental outlays" of many kinds, and, particularly, the customary heavy damage claims with the litigation expenses connected therewith. It was in this respect, it will be remembered, that the construction estimates were most faulty. The probable error here may well prove even greater because the cost of acquiring needed land space constitutes a much greater proportion of the total cost. Terminal engineering, also, is newer as a science than canal engineering, and this is another reason for believing that the present appropriation will prove quite insufficient.

Indeed, it is a certainty that further appropriations will be required for terminals, since the 1911 appropriation did not take into consideration or definitely provide for terminals along the Hudson River between Albany and New York. The State Engineer has already called attention to the early need of an additional appropriation for this section of the route.¹

Finally, the appropriation that has already been made for terminals in New York City is clearly inadequate for the needs there. The city itself in 1911 outlined a project, independent of the state, which calls for an initial expenditure of \$12,000,000 on terminal facilities.² Whether this plan has been given up the writer is unable to ascertain; but at any rate it is a clear indication of the probable needs in the metropolis.

It would obviously be a mere guess on the part of the writer to state the probable ultimate cost of providing the terminal facilities that will be required. Not being averse to prophecy, however, I may hazard an estimate of \$40,000,000 on this account. Something like a grand total of \$175,000,000 may, therefore, prove to be

¹ *Barge Canal Bulletin*, April, 1913, p. 148.

² *Ibid.*, 1911, pp. 107-8.

the ultimate expenditure of New York in rehabilitating her canal system.¹ This estimate would raise the figures of average cost per mile that were given above from \$260,000 to more than \$340,000, for the through distance from Buffalo to New York City. For purposes of comparison it may be added that the capitalization of the railroads of the United States averages approximately \$60,000 per mile.²

III

It has been seen that the question of terminals did not appear until several years after the barge-canal system in New York was approved. In a similar way the state has gone ahead building the canal without knowing what depth of channel is either desirable or necessary. It now appears that quite as serviceable a canal might have been provided at perhaps only a fraction of the present cost.

The depth of the new Erie Canal at the locks is to be 12 feet. No good reason has ever been given for this particular depth. Perhaps the most common statement has been that the failure of the old canal to retain its former tonnage was due to the inadequate depth of the 7-foot channel. To meet the competition of modern locomotives and cars barges of large capacity are necessary, and this in turn requires a waterway of ample depth. Looking forward to the future, 12 feet would certainly seem conservative enough. Another and perhaps more important argument has been that if the canal were made of ample depth boats could pass through the canal to and from the various lake ports without breaking bulk. But in this connection there was no investigation as to the practicability of lake and canal transportation by the same boats. As usual, investigation could be left until afterward.

¹ There is to be added to this estimate the \$7,000,000 appropriated for the Cayuga and Seneca branches.

² It has elsewhere been shown by the writer that the low transportation rates on the barge canal that are promised will be possible only because the state will charge no tolls on its waterways. The entire interest on the bonded indebtedness and even the cost of maintenance and upkeep of the canal are to be paid out of annual taxes. The canal rates, therefore, will merely cover direct haulage charges. But this shifting of a great part of the expense to the taxpayers does not lessen the cost as a whole. And if the inclusive cost is considered, it is easily shown that the entire undertaking will prove an enormous economic loss to the state. (See *Waterways versus Railways*.)

At last in 1911 the Barge Canal Terminal Commission recommended that it was important that a study be made of the best type of boat for use on the canal, but the advice passed unheeded. Just recently, again, the State Engineer has urged that "one of the matters that should receive the early attention of the state is that relating to the size of boats for navigation upon the opening of the barge canal."¹ It is apparent, therefore, that even yet there is no definite knowledge as to what is the most feasible boat for the canal or what its draft should be.

With reference to a type of boat that is adapted to both canal and lake navigation, it may safely be said that such a vessel will seldom if ever be used. Practically all of the tonnage now carried on the Great Lakes is carried in vessels with a registered draft of over 14 feet.² Many of the modern lake vessels draw over 19 feet of water. What few draw less than 12 feet are, moreover, not adapted to the navigation of a canal. "The ratio of length to beam is too great and the rudder power insufficient. Such vessels have been constructed for special purposes, and, while affording a most economical method of transporting freight on the Great Lakes, would be a failure if employed in either ocean or river navigation."³ Finally, it would not be profitable for the lake boats to navigate the canal, even were it possible and safe, for they would be unable to compete with barges. The average cost per ton of carrying capacity of constructing steam vessels used on the Great Lakes and the St. Lawrence River is \$61;⁴ while "a Mississippi River steamboat and ten barges, capable of transporting 10,000 tons of freight, can be built for about \$12 per ton of freight carried."⁵ Since a large steam vessel can make little if any greater speed in a narrow channel than can the barges, it is obvious that the latter offer the cheaper means of transport. The experience of other countries, moreover, entirely confirms this contention.

¹ *Barge Canal Bulletin*, July, 1914, p. 235.

² *Report by a Special Board of Engineers on the Survey of the Mississippi River*, 1909, p. 23.

³ *Ibid.*, p. 26.

⁴ *Preliminary Report of National Waterways Commission*, p. 40.

⁵ *Report by a Special Board of Engineers on the Survey of the Mississippi River*, 1909, p. 24.

But while the regular lake steamers are not adapted to canal navigation, may not a special type, a sort of hybrid boat, be devised which will fulfil the need? Possibly, though the evidence thus far is all the other way. A western manufacturing company recently asked the Great Lakes Engineering Works to devise such a vessel—one suitable for navigating the water routes between New York City and ports of the Great Lakes, and also adapted to the company's needs. "The shipbuilders have found it impracticable to design a steamer that will satisfy the requirements of the federal government for steam craft navigating the Great Lakes and also to keep within the limitations imposed by the barge canal, such as restricted clearance of 15.5 feet under bridges and other fixed structures, at high navigable stage, the narrow width of 75 feet in land sections, and shallow depth of 12 feet."¹ The solution that is offered is a fleet of large tow-barges with the requisite number of tugs—small tugs for the canal and large tugs for the open lakes.

Now if barges are to be used exclusively, the question becomes merely one as to the best size and the necessary depth of channel therefor. On an open and comparatively straight river it may practically be said that the larger the barge the less the cost per ton. On a canal, however, curves and channel width are very important determinants of the size of boats that may be used—more important indeed than the depth of the channel. The Erie channel is to be but 75 feet wide in places and hence 36 or 37 feet will measure the width of barges that can be used while permitting them to pass each other. Boats 300 feet long can make all the curves in the canals, but as they will take up the full width of the channel while rounding the worst bends, they would have to slow down to a speed of only about two miles an hour at those places,² and would seriously interfere with other traffic. For this reason a barge 150 feet in length, 36 or 37 feet wide, with a capacity of 1,500 or 1,600 tons, has been generally favored. Many believe that tows of smaller barges of 700 or 800 tons burden each, four of which could be locked at once, would be even more satisfactory. In Germany, where canal transportation has reached its greatest development,

¹ *Barge Canal Bulletin*, July, 1914, p. 236.

² *Ibid.*

barges of 600 tons capacity are regarded as the most economical for purposes of canal transportation. The far greater cost of larger canals much more than counterbalances the slight gains that go with larger barges.

A great depth of channel is not required for economical barge transportation. For instance, the fleets of coal barges on the Ohio and lower Mississippi rivers, of which so much has been written, have to be content with a depth of 6 feet and even less for the greater part of each year.¹ On the Rhine in Germany, barges of 2,000 tons capacity regularly ascend the river as far as Mannheim, where the low mean channel depth is only 6.52 feet. Between Mannheim and Strasburg, the head of navigation on the Rhine, the low mean depth is but 3.91 feet, but barges of 800 tons burden reach the latter port.² In fact, the greater part of the vast canal traffic of Europe is carried on canals with a depth of less than 7 feet.

Evidently, the failure of the old Erie Canal was not primarily due to its inadequate depth. Evidently, also (even assuming canal transportation is economical),³ a great part of the present outlays in New York is but a needless sinking of state funds. While the greater width may have been required, the extra depth appears to have been almost, if not quite, superfluous. It will be interesting to see, however, if other localities do not cheerfully go and do likewise.

H. G. MOULTON

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¹ *Report of Examination of Ohio River by United States Engineers*, 1908, p. 7.

² Sympher (Director of German Waterways Department) in *London Daily Chronicle*, April 7, 1906.

³ See footnote on p. 497.